

REMARKS

// Amendments:

For more clearly defining the present invention, the Applicants have amended claim 1 to change the cyclic dimer content (formerly "not greater than 2 % by weight") to not greater than "1.5" % by weight. **Support** for this amendment is found at page 37, line 16 of the present specification.

The Applicants have also added new claims 9 to 14 as described below.

New claim 9 is an independent method claim which has been formulated by rewriting, in independent form, the combination of claim 3 and **claim 5** and which is directed to the production of a polytrimethylene terephthalate resin as defined in claim 1 before the above-mentioned amendment thereto.

New claim 10 is an independent method claim which has been formulated by rewriting, in independent form, the combination of claim 3 and **claim 6** and which is directed to the production of a polytrimethylene terephthalate resin as defined in claim 1 before the above-mentioned amendment thereto.

New claims 11 to 13 (each depending from new claim 9 or 10) respectively have the same features as claims 4, 7 and 8.

New claim 14 (depending from new claim 9 or 10) states that the polytrimethylene terephthalate resin has a cyclic dimer content of not greater than 1.5 % by weight. That is, new claim 14 is directed to the production of the polytrimethylene terephthalate resin of amended claim 1. **Support** for this amendment is found at page 37, line 16 of the present specification.

In accordance with the introduction of new claims 9, 10 and 14, claims 5 and 6 have been cancelled.

Therefore, no new matter has been introduced by the amendments.

/// Background information:

For solving the problems accompanying the solid-phase polymerization process, there have been proposed various, improved melt polymerization processes.

However, conventionally, the problems of the related art have not yet been satisfactorily solved. More specifically, for example, a polytrimethylene terephthalate (PTT) resin having not only a molecular weight distribution (Mw/Mn) as narrow as from 2 to 2.7, but also a cyclic dimer content as small as not greater than 1.5 % by weight has not conventionally been obtained.

As a result of the present inventors' extensive and intensive studies for solving the above-mentioned problems accompanying the related art and for developing a polytrimethylene terephthalate (PTT) resin which although not claimed, potentially may be used as a raw material for stably producing, on a commercial scale, a shaped article having high quality (i.e., shaped article which has excellent strength and color, and which is free from the bleeding of the cyclic dimer to the surface of the shaped article, so that the shaped article is suitable for coating with a coating composition or adhesive agent and exhibits excellent adhesion properties), **it has unexpectedly been found** that, when a crude PTT resin (used as a raw material for the PTT resin of a final PTT resin having advantageously low cyclic dimer content) is produced by a specific method (e.g., a method using a specific catalyst), it becomes possible to obtain a crude PTT resin which is **capable of suppressing the formation of the cyclic dimer even when** the crude PTT resin is melted. Further, by **removing the cyclic dimer** from the obtained crude resin in a molten form, it becomes possible to obtain a PTT resin having an intrinsic viscosity $[\eta]$ **as high as** from 0.74 to 4 dl/g, a molecular weight distribution (Mw/Mn) **as narrow as** from 2 to 2.7, a cyclic dimer content **as small as** not greater than 1.5 % by weight, and a psychometric lightness L-value of from 70 to 100 and a psychometric chroma b^* -value of from -5 to 25. By using such a PTT resin, it becomes possible to produce an excellent shaped article stably on a commercial scale. Specifically, the **shaped article produced** using the polytrimethylene terephthalate resin of the present invention has **high strength and excellent color**. Further, the shaped article is **free from the bleeding of the cyclic dimer** to the surface of the shaped article, so that the shaped article is **suitable for coating** with a coating composition or adhesive agent and exhibits **excellent adhesion property**.

One potential object was to provide a polytrimethylene terephthalate resin which can be used for stably producing, on a commercial scale, a shaped article which has high

strength and excellent color, and which is free from the bleeding of the cyclic dimer to the surface of the shaped article, so that the shaped article is suitable for coating with a coating composition or adhesive agent and exhibits excellent adhesion property.

Instantly amended **claim 1** of the present application is essentially directed to a polytrimethylene terephthalate resin comprising:

60 to 100 mole % of (a) trimethylene terephthalate recurring units, and

0 to 40 mole % of (b) at least one monomer unit obtained from a comonomer copolymerizable with at least one of the monomers used for forming the trimethylene terephthalate recurring units,

the total molar amount of (a) monomer units and (b) monomer units being 100 mole %,

the polytrimethylene terephthalate resin having the following characteristics (A) to (D):

(A) an intrinsic viscosity $[\eta]$ of from 0.74 to 4 dl/g;

(B) a molecular weight distribution (M_w/M_n) of from 2 to 2.7;

(C) a cyclic dimer content of not greater than 1.5 % by weight, the cyclic dimer being represented by formula (1); and

(D) a psychometric lightness L-value of from 70 to 100 and a psychometric chroma b^* -value of from -5 to 25.

Claim 3 of the present application is essentially directed to a method for producing the polytrimethylene terephthalate resin of the present invention, which comprises:

(1) providing a crude trimethylene terephthalate resin in a molten form, said crude trimethylene terephthalate resin comprising:

60 to 100 mole % of (a) trimethylene terephthalate recurring units, and

0 to 40 mole % of (b) at least one monomer unit obtained from a comonomer copolymerizable with at least one of the monomers used for forming the trimethylene terephthalate recurring units,

the total molar amount of (a) monomer units and (b) monomer units being 100 mole %,

said crude trimethylene terephthalate resin further comprising a cyclic dimer of formula (1),

said crude trimethylene terephthalate resin having an intrinsic viscosity $[\eta]$ of from 0.2 to 4 dl/g and a cyclic dimer formation index (E) of less than 0.066, said cyclic dimer formation index (E) being defined by formula (3); and

(2) removing, from said crude polytrimethylene terephthalate resin in a molten form, 0.5 % by weight or more, based on the weight of said crude polytrimethylene terephthalate resin, of said cyclic dimer, by volatilization under reduced pressure.

/// With regard to the rejection of the claims

(III-1)

(rejection of claims 1 and 2 under 35 USC § 103)

Claims 1 and 2 have been rejected under 35 USC 103(a) as being unpatentable over Kato et al. (WO 99/11709) in view of Scardino et al. (US 2002/0032302). The reasons for the rejection are substantially the same as in the previous office action dated June 12, 2008.

(rejection of claims 3 to 8 under 35 USC § 103)

Claims 3 to 8 have been rejected under 35 USC 103(a) as being unpatentable over Kato et al. (WO 99/11709) in view of Scardino et al. (US 2002/0032302). The reasons for the rejection are substantially the same as in the previous office action dated June 12, 2008.

In the section "**Response to Arguments**" at pages 7 to 10 of the office action, the Examiner gives comments on the Applicants' arguments in the Applicants' Response (dated September 23, 2008) to the previous office action dated June 12, 2008. In the item A) of the section "Response to Arguments", the Examiner states as follows.

"While Scardino et al. teaches that cyclic dimer content cannot be reduced below about 2.5 weight percent by the selection of catalysts (¶0015), this is contradicted by the disclosure of Kato et al. Kato et al. teaches that the amount of cyclic dimer can be reduced to amounts as low as 1.7 percent without the need for a solid state post polymerization, by using a

phosphorous compound in conjunction with a titanium compound (Examples 1-7, Table 3). Therefore, as Kato et al. has shown that the amount of cyclic dimer can be reduced through the selection of the proper catalyst system, the long-felt need as identified in Scardino et al., has been satisfied by another prior to the applicant's invention."

(emphasis added) (see page 7, lines 17 to 25 of the present specification)

The Applicants wish to respond as follows.

In view of the Examiner's above-quoted statement, the Applicants have amended claim 1 to change the cyclic dimer content (formerly "not greater than 2 % by weight") to not greater than "1.5" % by weight, which is smaller than the Examiner's indicated value (1.7 percent) as achieved in Example 2 of Kato et al.

In Kato et al., the task of achieving a cyclic dimer content of not greater than "1.5" % by weight is not achieved, except for Example 8 of Kato et al., in which a cyclic dimer content of "0.9 wt.%" is attained using the ***solid-phase*** polymerization technique.

With respect to such **Example 8** (using the ***solid-phase*** polymerization technique) of Kato et al., attention is drawn to the fact that the PTT resin obtained in **Example 8 of Kato et al.** exhibits a broad **molecular weight distribution (Mw/Mn)** value which does not **satisfy** the molecular weight distribution (Mw/Mn) requirement (from 2 to 2.7) of **claim 1** of the present application. The reason for this has already been explained in the below-quoted portion at page 45, lines 2 to 15 of the Applicants' February 29, 2008 Response to the 1st office action dated October 31, 2007:

"Further, it should also be noted that such **Example 8 of Kato et al.** (employing a ***solid-phase*** polymerization process) is substantially ***equivalent*** to (the above-described) **Comparative Example 9** of the **present specification** (see item (I-2-ii) above). As described in item (I-2-ii) above, **Comparative Example 9** of the present specification employs a ***solid-phase*** polymerization process.

Therefore, it is believed that, just as in the case of **Comparative Example 9** of the present specification, the PTT resin obtained in **Example 8 of Kato et al.** exhibits a **molecular weight distribution (Mw/Mn)** as **broad as 3**, which does not **satisfy** the molecular

weight distribution (Mw/Mn) requirement (from 2 to 2.7) of **claim 1** of the present application. The Examiner's molecular weight distribution allegation is not correct."

(see page 45, lines 2 to 15 of the Applicants' February 29, 2008 Response to the 1st office action dated October 31, 2007)

Thus, a polytrimethylene terephthalate resin satisfying **all excellent features** of claim 1 (including a cyclic dimer content of not greater than "1.5" % by weight) of the present application **cannot** be obtained by any method of Kato et al.

Such a polytrimethylene terephthalate resin satisfying **all excellent features** of claim 1 (including a cyclic dimer content of not greater than "1.5" % by weight) of the present application has **for the first time** been achieved by the present invention.

As apparent from the above, all of claims 1 to 8 of the present application are **non-obviousness** over the combined teachings of Kato et al. and Scardino et al.

It is believed that the rejection of claims 1 to 8 over Kato et al. and Scardino et al. has been removed by the above explanations and the amendment.

(III-2) (rejection of claims 1 to 8 on the ground of double patenting)

Claims 1 to 8 have been rejected on the ground of obviousness-type double patenting as being unpatentable over claims 1 and 9 of U.S. Patent No. 7,198,846 in view of Kato et al. (WO 99/11709) and Scardino et al. (US 2002/0032302).

The Applicants wish to respond as follows.

The Applicants have filed a terminal disclaimer.

It is believed that the double patenting-based rejection has been removed by the terminal disclaimer.

/IV/ New Claims

On February 24, 2009, Examiner Heincer kindly granted the undersigned an interview. The Examiner's time in preparing for and conducting the interview is acknowledged and gratefully appreciated.

During the interview, method claims, such as claim 3 and new independent claims 9 and 10, were discussed. Specifically, applicants pointed out that these claims (1) providing a crude trimethylene terephthalate resin in a molten form, (2) removing cyclic dimer from crude PTT in a molten form by volatilization under reduced pressure, (3) an intrinsic viscosity of from 0.75 to 4 dl/g and (4) a cyclic dimer content no greater than 2% by weight. The Examiner cites example 2 of Kato et al. for melt polymerization and a cyclic dimer content of less than 2 wt%. The Examiner argues that Kato et al. achieves a good cyclic dimer content using a phosphorus system. Example 2 of Kato et al. has an intrinsic viscosity of 0.70, outside of the 0.75 to 4 range. The Examiner argues that it would have been obvious to combine the melt polymerization technique of example 2 with solid-phase polymerization step in order reduce the intrinsic viscosity. The Examiner cites column 10, lines 34-62 of US Patent no. 6,423,814 ("the '814 patent"), which corresponds with the Kato et al. PCT publication.

Column 10, lines 40-42 of US '814 indicates that to attain an intrinsic viscosity of 0.81 or more, a method of using solid-phase polymerization is preferably used. Column 10, lines 60-62 describe combining melt polymerization and solid phase polymerization. The Examiner's hypothetically modified example 2 uses melt polymerization and solid-phase polymerization.

It appears the Examiner relies upon Scardino et al. for an all-melt polymerization process. Paragraphs [0011] and [0012] of Scardino et al. teach that PTT can be prepared from a two-stage process. In the first stage, melt polycondensation is performed. In the second stage, a vacuum process is performed. Paragraph [0010] teaches that a cyclic dimer byproduct can be removed during the vacuum step.

However, the Examiner is treating Kato et al. as if Kato et al. specifically stated that the additional solid-phase step (10:34-37) should be used with example 2. That is, the Examiner is treating example 2 of Kato et al. as if example 2 (1) employed an additional solid-phase step and (2) achieved a higher viscosity. However, even if the Examiner were otherwise correct in his understanding of the reference, there is nothing that specifically teaches that column 10, lines 34-37 should be combined with example 2. The modified example 2, relied upon by the Examiner, is somewhat hypothetical and imaginary. It would not have been obvious to use Scardino et al. to further modify a hypothetical example, which does not actually exist in the reference.

In addition, even if the combination would have been obvious, the present invention would not result. Kato et al. teaches that solid-phase polymerization is used in order to increase the viscosity. Scardino et al. teaches that the process produces a product having a viscosity of

less than 0.3, usually within the range of about 0.05 to about 0.25. If the Examiner's hypothetical modification would be performed, it is submitted that the increase in viscosity mentioned at column 10, lines 40-42 of US '814 would be lost if the Kato et al. solid-phase step were replaced with the Scardino et al. vacuum step.

IV/ Conclusion

Thus, it is believed that all rejections and objections have been removed, and the present application is now in condition for allowance.

Reconsideration and early favorable action on the claims are earnestly solicited.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited. At a minimum, this Amendment should be entered at least for purposes of Appeal as it either clarifies and/or narrows the issues for consideration by the Board.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited and possibly concluded by the Examiner contacting the undersigned attorney for a telephone interview to discuss any such remaining issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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